

REMARKS

Applicant requests favorable reconsideration and allowance of the subject application in view of the preceding amendments and the following remarks.

The specification has been amended to correct minor informalities, included those noted by the Examiner. No new matter has been added by these changes.

Claims 19-24 are presented for consideration. Claims 19, 22 and 23 are independent. Claims 23 and 24 have been added to clarify features of the subject invention. Support for these claims can be found in the original application, as filed. Therefore, no new matter has been added.

Applicant request favorable reconsideration and withdrawal of the rejections set forth in the above-noted Office Action.

Claims 19 and 22 were rejected under 35 U.S.C. § 102 as being anticipated by U.S. Patent No. 6,285,437 (Tokunaga). Claim 20 was rejected under 35 U.S.C. § 103 as being unpatentable over the Tokunaga patent in view of U.S. Patent No. 5,448,333 (Iwamoto). Claim 21 was rejected under 35 U.S.C. § 103 as being unpatentable over the Tokunaga patent in view of U.S. Patent No. 5,640,227 to Tako, et al. Applicants submit that the cited art, whether taken individually or in combination, does not teach many features of the present invention, as recited in claims 19-22. Therefore, these rejections are respectfully traversed.

In one aspect of the invention, independent claim 19 recites a scan type exposure apparatus including a first stage on which a first object is placed, a second stage on which a second object is placed, and a projection optical system for projecting a pattern of the first object

on to the second object. The apparatus further includes a scanning mechanism and a signal system. The scanning mechanism is arranged to scanningly move the first and second stages in a timed relation with each other, relative to the projection optical system, while the pattern of the first object is projected by the projection optical system onto the second object. The signal system is systemized to store data corresponding to a change in an exposure condition, the change in the exposure condition is produced in response to scan motion of at least one of the first and second stages and in accordance with one of scan acceleration and scan speed, and the data is measured beforehand by obtaining data of a projected image of the pattern of the first object, being formed on the second object through the projection optical system, while scanningly moving at least one of the first and second stages. The signal system is further systemized to control a drive of the first and second stages in an actual exposure process while reflecting a correction value, as determined on the basis of the data stored, to the driving of at least one of the first and second stages.

In another aspect of the invention, independent claim 22 recites a device manufacturing method including a pattern exposure step for performing exposure by use of a scan type exposure apparatus including (i) a first stage on which a first object is placed, (ii) a second stage on which a second object is placed, (iii) a projection optical system for projecting a pattern of the first object onto the second object, (iv) a scanning mechanism arranged to scanningly move the first and second stages in a timed relation with each other, relative to the projection optical system, while the pattern of the first object is projected by the projection optical system onto the second object, and (v) a signal system systemized to store data corresponding to a change in an exposure

condition. The change in the exposure condition is produced in response to scan motion of at least one of the first and second stages and in accordance with one of scan acceleration and scan speed, and the data is measured beforehand by obtaining data of a projected image of the pattern of the first object, being formed on the second object through the projection optical system, while scanningly moving at least one of the first and second stages. The signal system is further systemized to control drive of the first and second stages in an actual exposure process while reflecting a correction value, as determined on the basis of the data stored, to the driving of at least one of the first and second stages. The method further includes a development step for developing the second object pattern exposed by the scan type exposure apparatus. A circuit pattern can be formed on the basis of the developed exposed pattern.

In still another aspect of the invention, independent claim 23 recites a scan type exposure apparatus including a first stage on which a first object is placed, a second stage on which a second object is placed, and a projection optical system for projecting a pattern of the first object onto to the second object. The apparatus further includes a scanning mechanism, storing means and drive control means. The scanning mechanism is arranged to scanningly move the first and second stages in a timed relation with each other, relative to the projection optical system, while the pattern of the first object is projected by the projection optical system onto the second object. The storing means stores data related to a shift in a projected image due to vibration of the projection optical system. The drive control means changes a scan speed of at least one of the first and second stages on the basis of the stored data.

Accordingly, in the present invention recited in independent claims 19 and 22, for example, data corresponding to a change in exposure condition can be measured beforehand by obtaining data of a projected image of the pattern of the first object, being formed on the second object, through the projection optical system. Thus, by obtaining data of a projected image of the first object, while scanningly moving one of the first and second stages, the present invention assures that the data which corresponds to a change in exposure condition contains information concerning a shift in the projected image. One cause for such a shift of the projected image can be vibration of the projection optical system resulting from the scan motion of the first and/or second stages. The correction value referred to in independent claims 19 and 22 can, therefore, be determined on the basis of the data stored. Thus, the correction value can contain information regarding the shift in the projected image caused by the vibration of the projection optical system.

Accordingly, in the present invention recited in independent claims 19 and 22, in an actual exposure process, the signal system can control the drive of the first and second stages while reflecting the correction value. This assures that at least one of the first and second stages is driven while correcting a shift and a projected image resulting from vibration of the projection optical system.

In the present invention recited in independent claim 23, the scan-type exposure apparatus includes storing means for storing data related to a shift and a projected image due to vibration of the projection optical system, as well as drive control means for changing a scanning speed for

changing a scanning speed of at least one of the first and second stages on the basis of the stored data.

Applicant submits that the cited art does not teach or suggest such features of the present invention, as recited in independent claims 19, 22 and 23.

In the Tokunaga patent, the vibration amount of the wafer stage 20 and the mask stage (including a reticle coarse moving stage 22 and a reticle fine movement stage 24) is calculated. This is discussed in more detail in the Tokunaga patent at column 8, line 14 to column 10, line 5. Then, while taking into account the calculated vibration amounts, the motion speeds of the wafer stage 20 and the mask stage are controlled by means of a velocity control unit 50 and an RC velocity control unit 56, as discussed in this patent column 9, lines 39-54.

Applicant submits, however, that the Tokunaga patent does not teach or suggest anything regarding data of a projected image, in the manner of the present invention recited in independent claims 19 and 22. Although the Tokunaga patent refers to vibration of the wafer stage 20 and the mask stage, that patent does not teach or suggest anything about (i) vibration of the optical system PL due to scan motion of the wafer stage 20 or the mask stage, or (ii) a shift in the projected image caused by the vibration optical system.

Applicant submits, therefore, that the device in the Tokunaga patent is unable to detect a shift in a projected image which results from vibration of the projection optical system.

Applicant submits, therefore, that the device in that patent is unable to drive the first and or second stage while correcting a shift in the projected image in the manner of the present invention recited in independent claims 19 and 22.

Still further, Applicants submit that the Tokunaga patent does not teach or suggest the arrangement of the storing means or the drive control means of the present invention recited in independent claim 23.

Applicant further submits that the remaining art cited fails to cure the deficiencies noted above with respect to the Tokunaga patent.

The Examiner relies on the Iwamoto, et al. patent for teaching aligning of the shot areas of a substrate with a pattern formed on a mask by measuring deviation of a projected image pattern.

The Examiner relies on the Kato, et al. patent for minimizing the focusing by projecting an image of a pattern of a first object upon a second object.

Applicant submits, however, that neither the Iwamoto, et al. patent nor the Kato, et al. patent teaches or suggests the salient features of Applicant's present invention, as recited in independent claims 19, 22, and 23, which have been discussed above. Accordingly, those patents add nothing to the teachings of the Tokunaga patent that would render obvious, Applicant's present invention recited in those independent claims.

For the foregoing reasons, Applicant submits that the present invention, as recited in independent claims 19, 22 and 23, is patentably defined over the cited art.

Dependent claims 20, 21 and 24 also should be deemed allowable, in their own right, for defining other patentable features of the present invention in addition to those recited in their respective independent claims. Further individual consideration of these dependent claims is requested.

Applicant further submits that the instant application is in condition for allowance.
Favorable reconsideration, withdrawal of the objection and rejections set forth in the above-noted
Office Action and an early Notice of Allowance are requested.

Applicant's undersigned attorney may be reached in our Washington, D.C. office by
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Respectfully submitted,



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